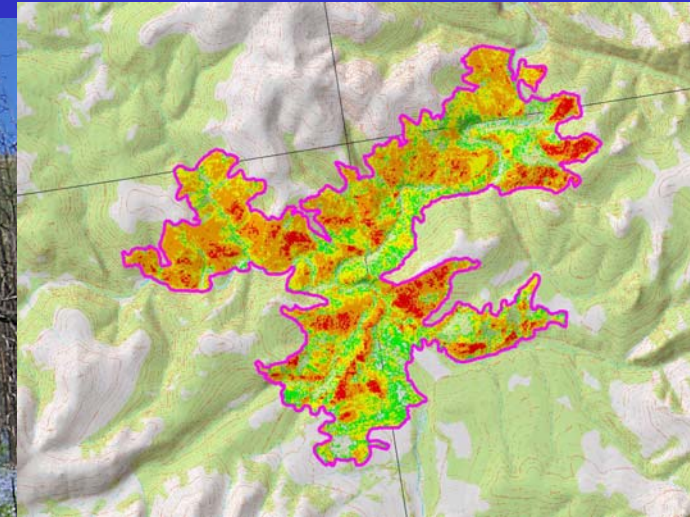


Assessing the Burn Severity of Wildland Fire in National Parks Using Landsat Imagery and the Normalized Burn Ratio



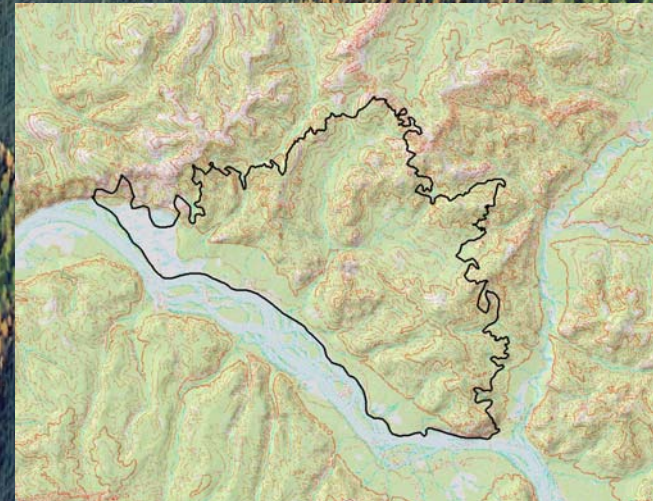
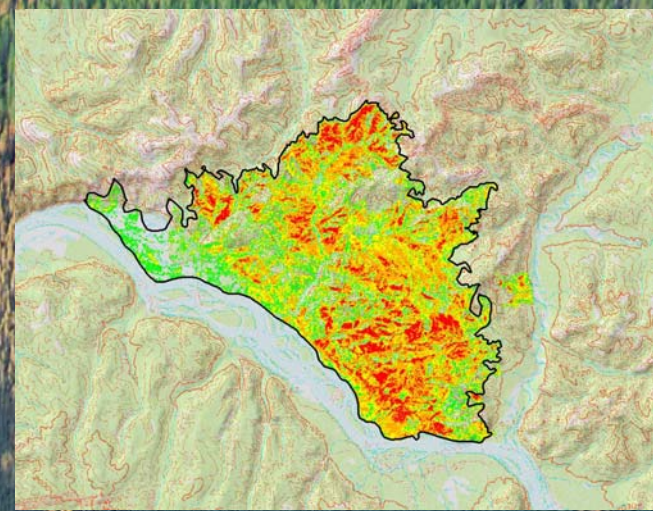
Brian Sorbel
Fire GIS Specialist
NPS Alaska Region

Objectives

- Define burn severity
- Describe why NPS fire management is interested in capturing burn severity
- Describe the Normalized Burn Ratio and corresponding Composite Burn Index methods of determining burn severity
- Describe the partnership with the EROS data center and the expected products

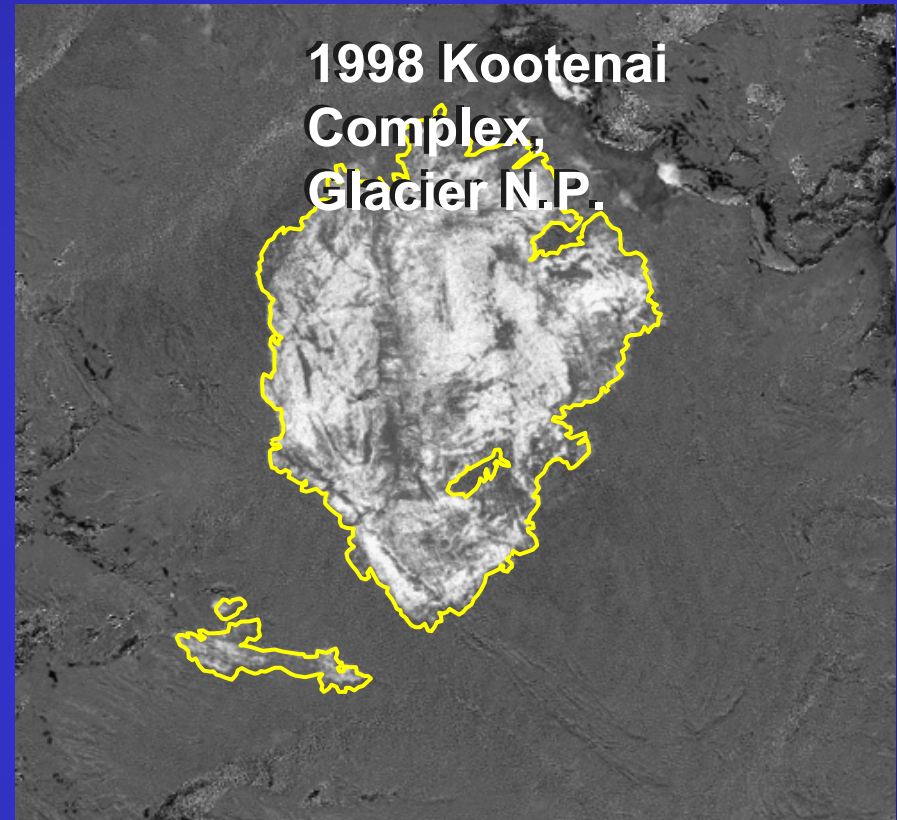
Burn Severity GIS Products

- A more complete depiction of fire's effect on a landscape
- Captures the mosaic nature of burn scars
- Applications
 - BEAR team assessments
 - Updating fuel model and vegetation layers
 - Research and modeling



The Normalized Burn Ratio (NBR)

- Developed by Carl Key (USGS) and Nate Benson (NPS Everglades)
- Compares pre-fire and post-fire Landsat scenes to generate a continuous index of burn severity
- Pre- and post-fire scenes should be on or near anniversary dates so that vegetation is in similar phenological states

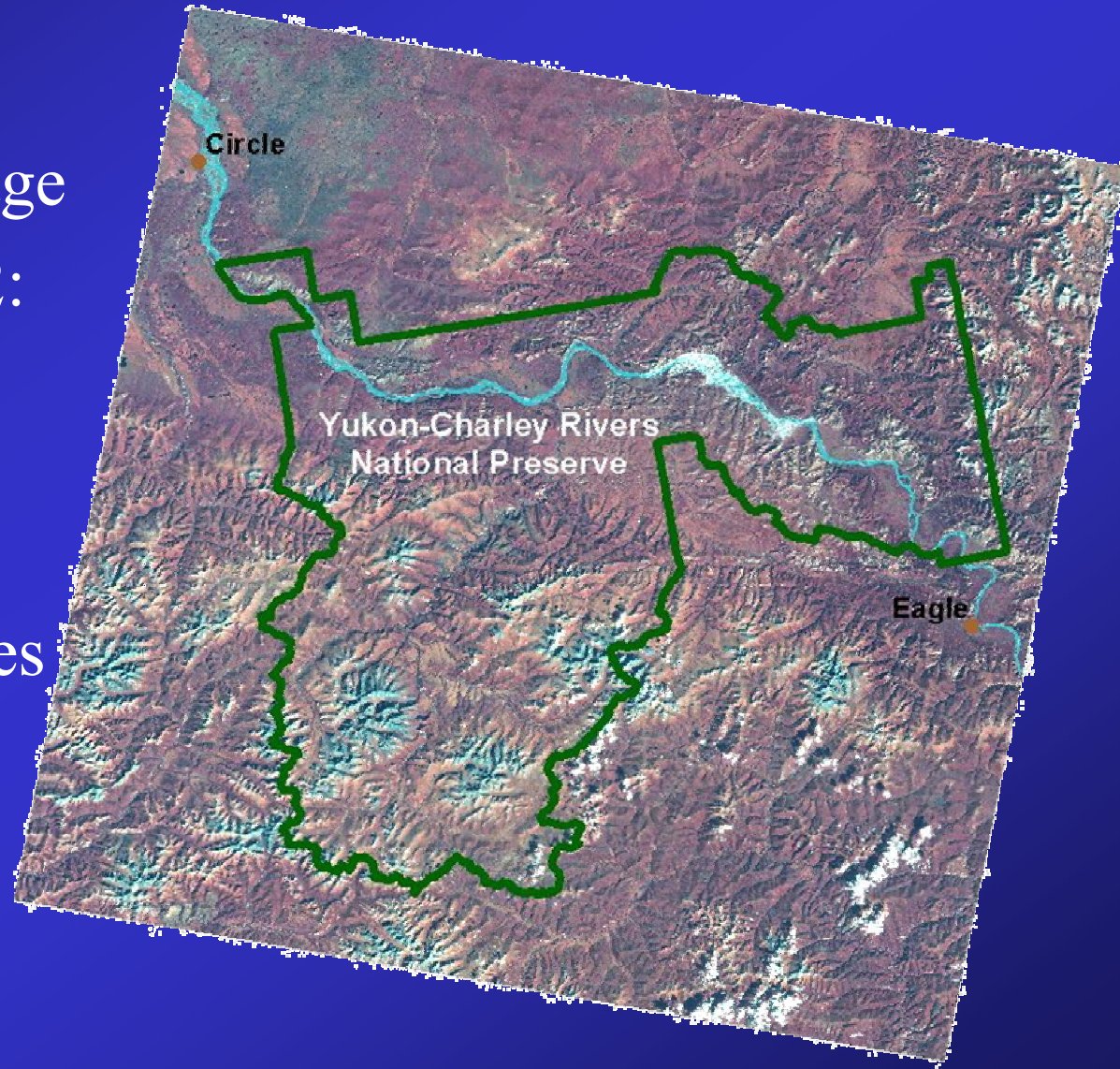


$$\text{NBR} = \frac{\text{TM4} - \text{TM7}}{\text{TM4} + \text{TM7}} \quad \text{Range (-1000 to 1000)}$$

$$\Delta\text{NBR} = \text{Prefire NBR} - \text{Postfire NBR} \quad \text{Range (-2000 to 2000)}$$

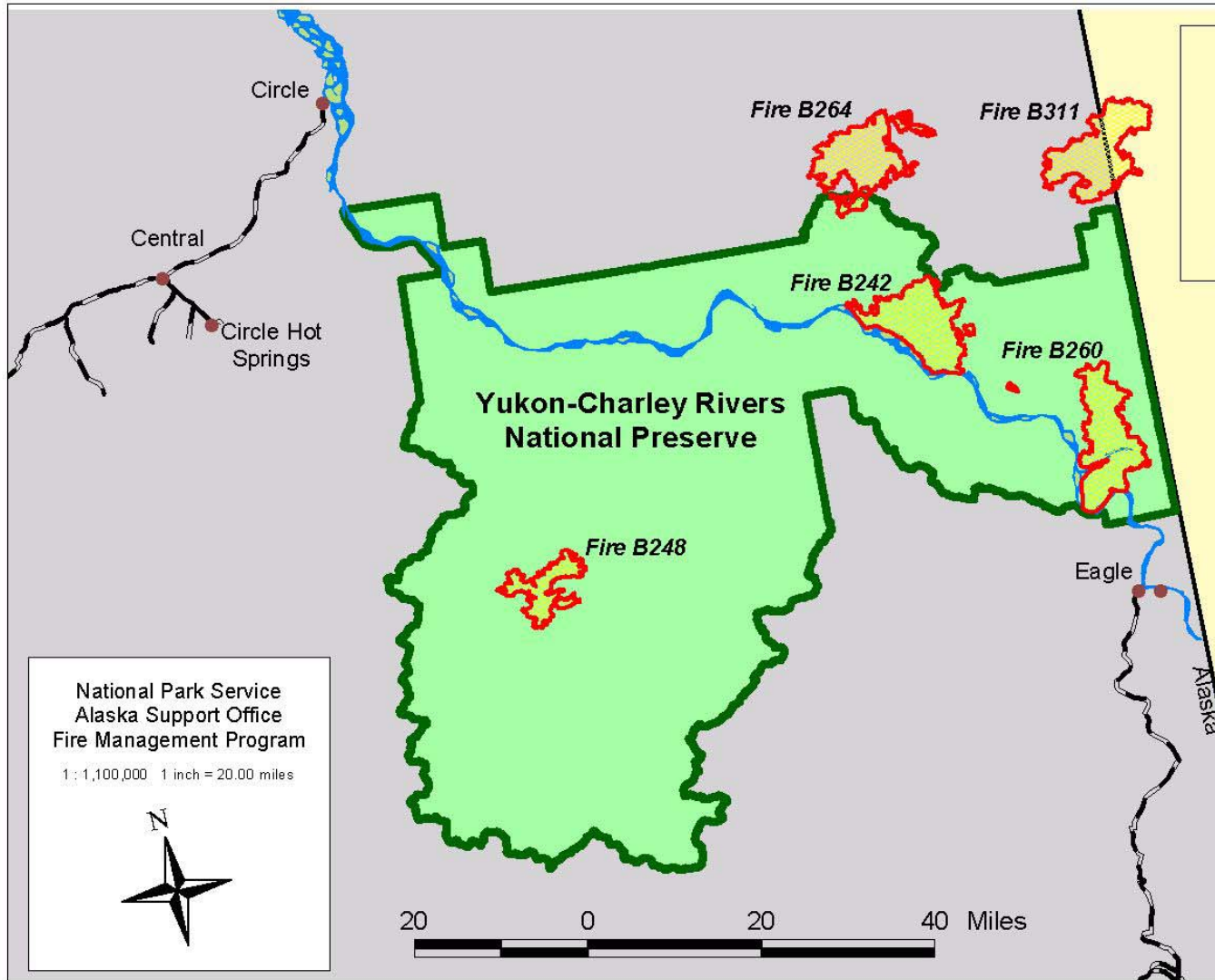
Landsat 7 ETM +

- 16 day repeat coverage
- 7 bands; NBR uses 2:
TM Bands 4 and 7
- 30 meter minimum
cell resolution
- Each scene=115 miles
x 115 miles
- Scene costs approx.
\$600



Yukon-Charley Rivers National Preserve

1999 Fires



National Park Service
Alaska Support Office
Fire Management Program

1 : 1,100,000 1 inch = 20.00 miles



20 0 20 40 Miles



Landsat Pre and Postfire Views of the Beverly Fire, YUCH 1999

Post-fire NBR

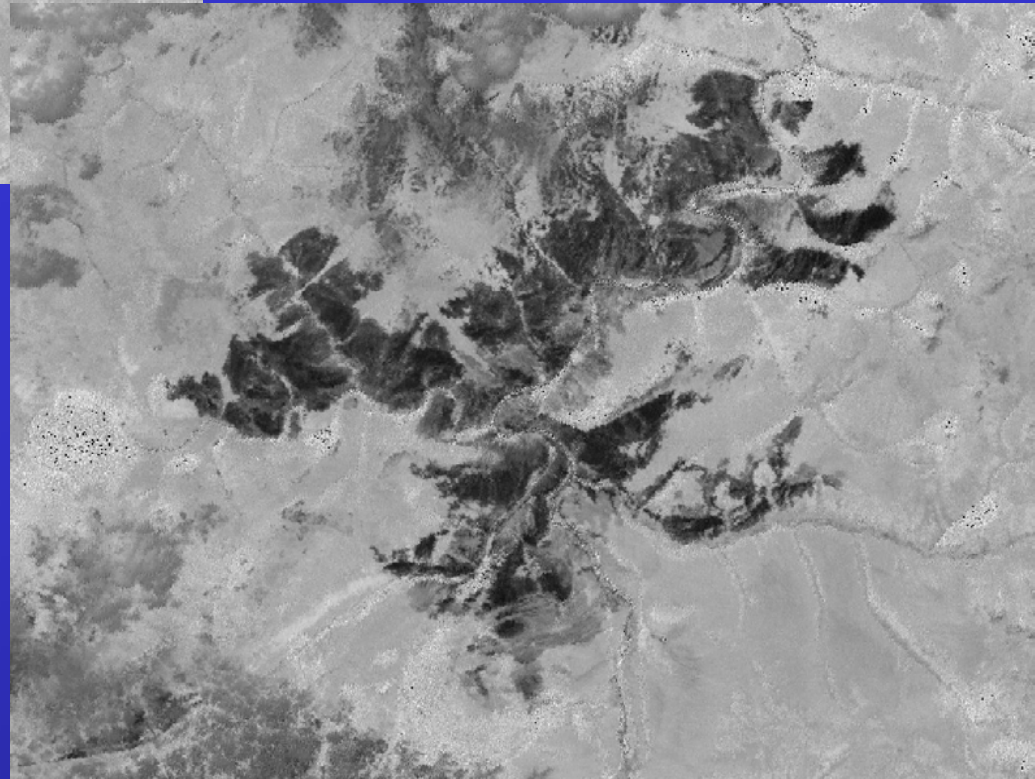
9-12-99



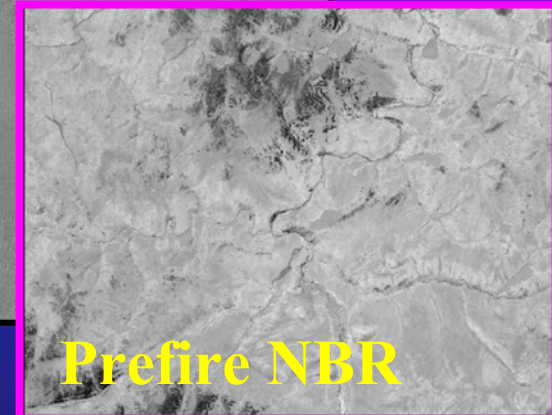
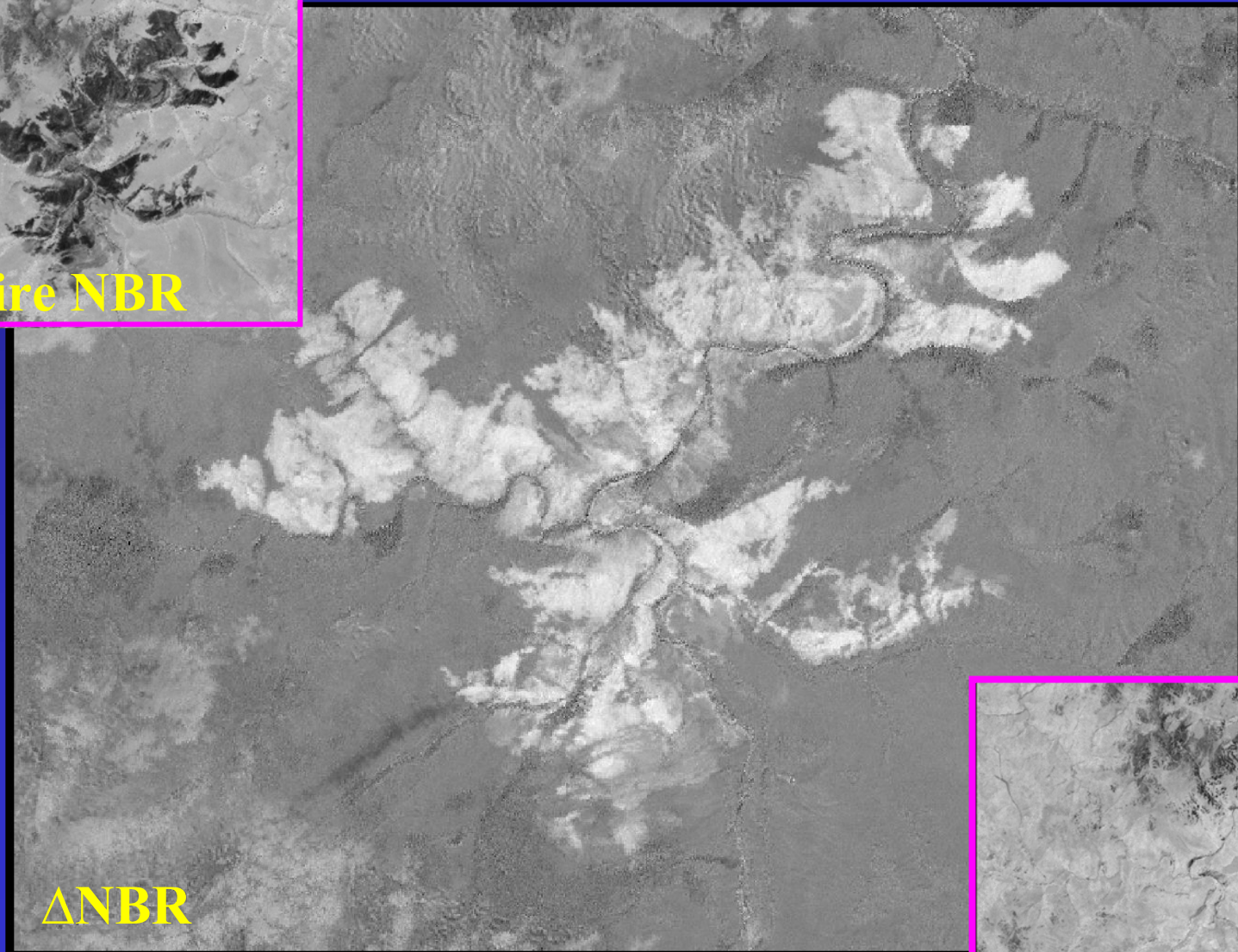
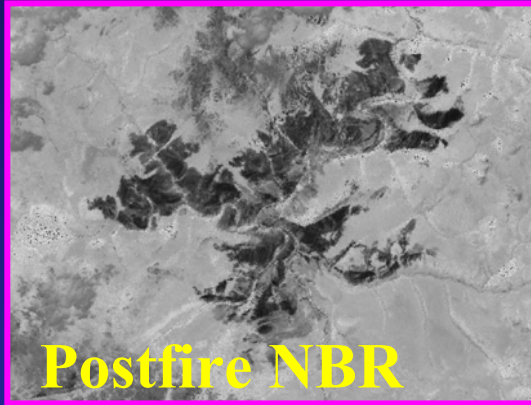
Pre-fire NBR

9-16-95

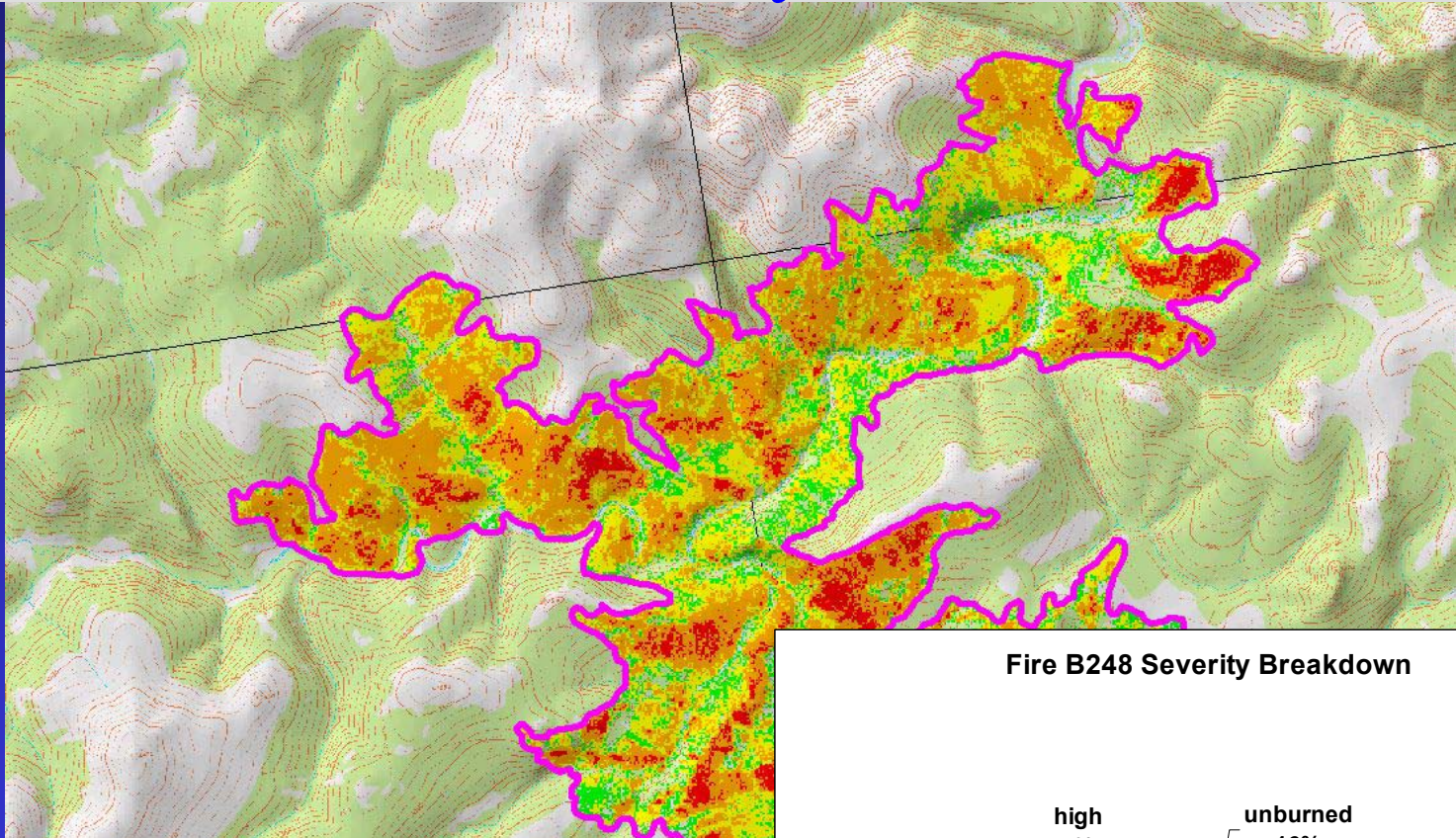
$$\text{NBR} = \frac{\text{TM4} - \text{TM7}}{\text{TM4} + \text{TM7}}$$



Differenced NBR (ΔNBR) = Prefire NBR – Postfire NBR

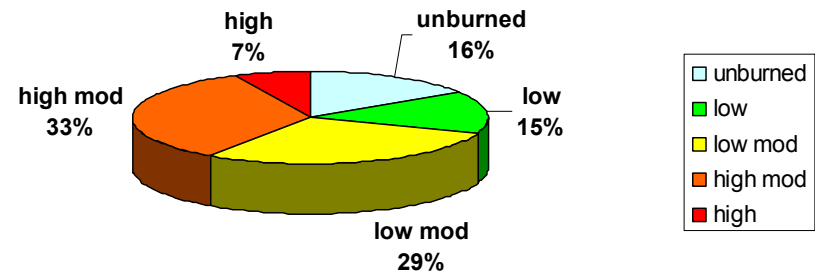


Final Perimeter Delineation & Landscape Level Burn Severity Determination



- Low Severity ($\Delta\text{NBR} = 75 - 220$)
- Moderate Low ($\Delta\text{NBR} = 220 - 480$)
- Moderate High ($\Delta\text{NBR} = 480 - 780$)
- High Severity ($\Delta\text{NBR} = 780 - 1100$)

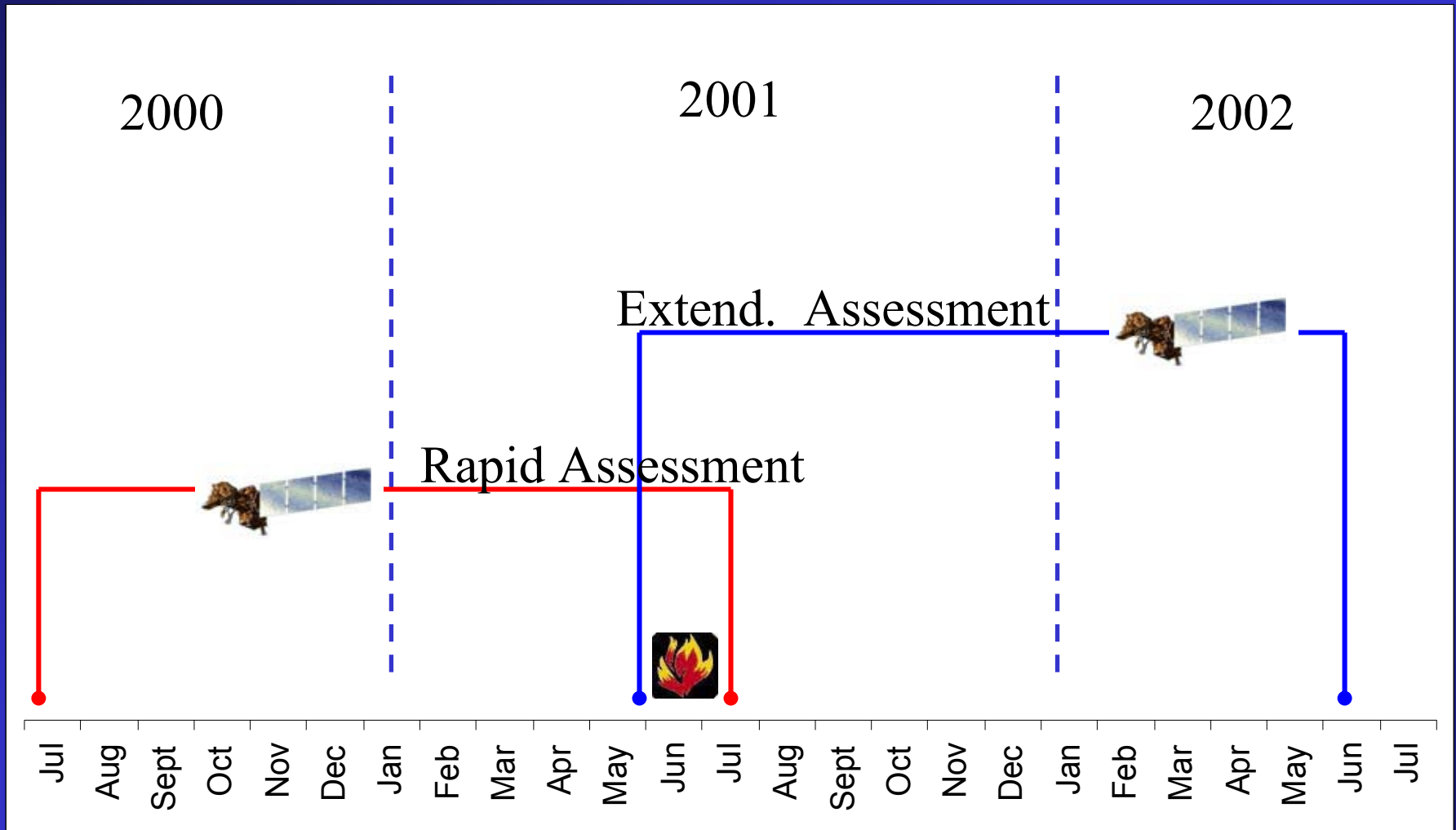
Fire B248 Severity Breakdown



Scene selection criteria and processing specifics

- Landsat scenes should be terrain corrected
- Bands 4 and 7 should be processed from original digital number values to units of reflectance prior to calculation of NBR
- Pre- and post-fire scenes should be on or near anniversary dates so that vegetation is in similar phenological states

Rapid Assessment vs. Extended Assessment



Extended Assessment – “Best” index of burn severity

Rapid Assessment – Good definition of areas burned and perimeter

Field Verification through the Composite Burn Index (CBI)

- Ocular estimate of burn severity
- Crews estimate the degree of change in individual components of five strata of vegetation
 - Substrate (litter, duff, 1000 hr fuels, etc.)
 - Low Shrubs (regeneration, new serals, Δ richness/cover)
 - Tall Shrubs (% consumed, regeneration, new serals, Δ richness/cover)
 - Intermediate Trees (% green, % brown, % black)
 - Big Trees (% green, % brown, % black)

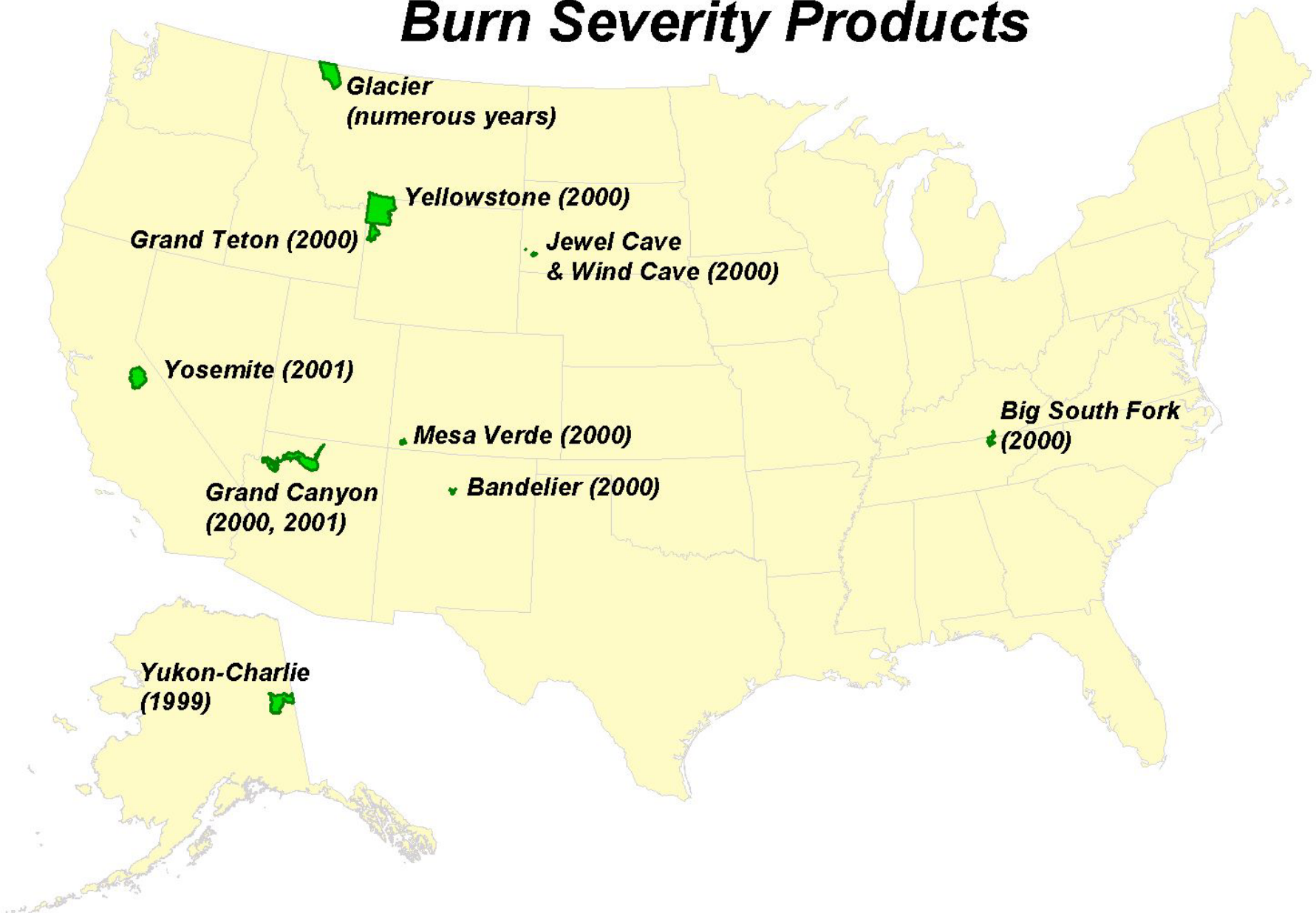


USGS EROS Data Center Partnership



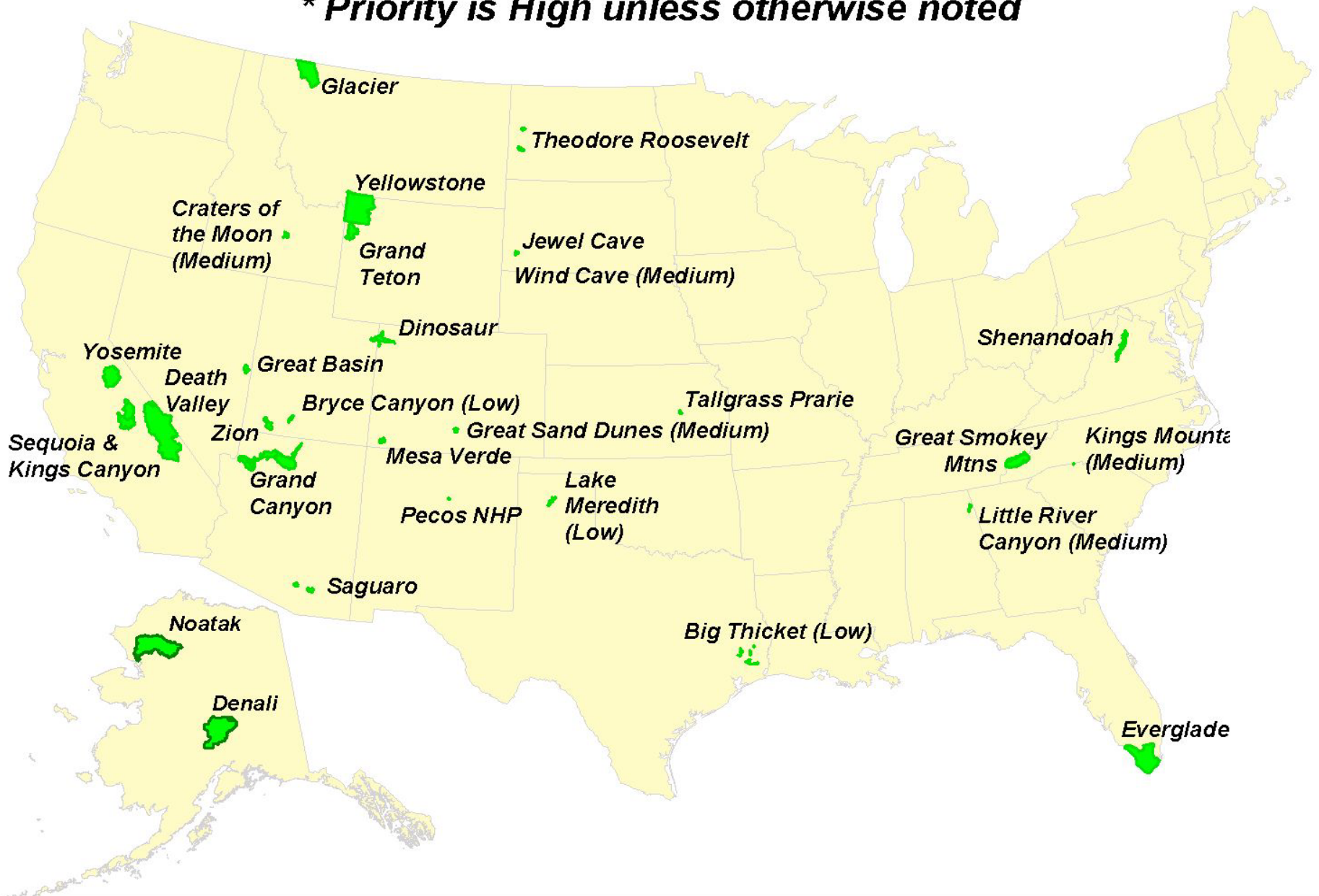
- NPS Fire Management sufficiently interested in initial results of NBR burn severity processing to pursue large-scale nationwide testing
- EROS Data Center (EDC) responsible for processing, distribution and archiving of Landsat data
- Funding secure to generate burn severity products for significant fires through 2002/2003
- Priorities determined based on a fire's size, level of regional importance, vegetation type and local need.

NPS Units and Years with Completed Burn Severity Products



Planned Burn Severity Projects

** Priority is High unless otherwise noted*



Additional Information

- Complete documentation and methods:
<http://www.fire.org/firemon>, link to
Landscape Assessment and Remote Sensing Measures
- Nate Benson – Prescribed Fire Spec. (EVER)
phone: 305-242-7851;
email: nate_benson@nps.gov